Space Weather Forecast

Issued on Friday, 11 February 2022 at 12:53 Local

This forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Effects of 06 February CME continuing. Chance of fast wind Minor Geomagnetic Storm G1 over weekend.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been low over the last 24 hours, with isolated low-level X-ray flares. There are potentially at least six sunspot regions on the sun at present, with a strong bias in population towards the western solar hemisphere. Of these potential regions, many are now nearing the western solar horizon, and as a consequence now appear unipolar (underplaying their flare risk).

In the eastern solar hemisphere, activity was more limited, however another area seeing growth emerged near the eastern horizon. Finally, the recent largest sunspot group on the sun near the middle of the sun saw a weakening trend in the period.

A minor flare and 'coronal dimming' was seen around 10/2030UTC from the southwest of the sun. This may have resulted in an at least partially westward-directed (ahead of the Earth in its orbit) CME now showing in satellite imagery, with analysis yet to be carried out.

In addition to the above, a 'partial halo' CME is now also becoming visible on imagery. This event has yet to be analysed (as with the aforementioned dimming CME) however this second event may be far-sided. No other Coronal Mass Ejections (CMEs) were in evidence in the period.

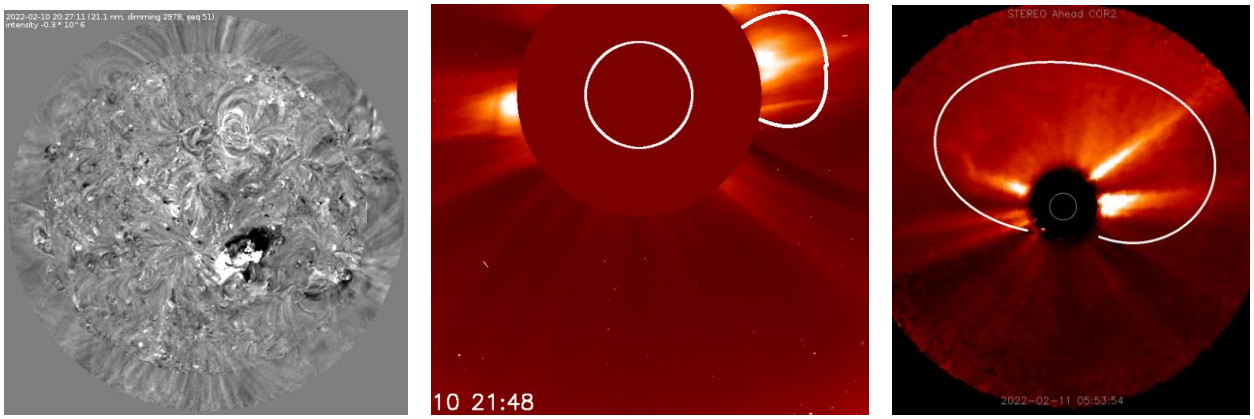

Figure 1: Left: SIDC ROB time-integrated extreme UV sequence of a 'dimming' in the sun's corona, often a sign of a released CME. Shown in the central image is the possible resultant CME. Right: A second CME from the perspective of a satellite trailing Earth in its orbit by 30 degrees, implying an emission location from roughly 60 degrees round the western far side of the sun given its partial halo-like appearance. These features will be fully analysed in due course.

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Solar Wind / Geomagnetic Activity: Earth spent much of the past 24 hours in a 'magnetic cloud'-like environment, thought to be the (expected) tail end of the CME that left the sun on 06 February, with onset at L1 from 09/2013UTC. This enhancement did however see a noteworthy kick late in the reporting period around 11/0930UTC. This CME was modelled as three separate lobes in MOSWOC modelling, and it is not impossible that this latest resurgence in some solar wind measures represents a further swipe from a component part, although this is not confirmed. The 24-hour period as a whole mainly comprised a smoothly varying solar wind magnetic field, which spent much of the first half of the period strongly anti-aligned with Earth's field (to maximum geomagnetic effect), later transitioning to become co-aligned with time, a trait that strengthened after 11/0930UTC. Bt peaked late, but co-aligned as stated. The solar wind speed showed a declining trend for much of the period, before rallying at the 24-hour period's end.

The net result of the above solar wind measures showed a strong dependence on the orientation of the solar magnetic field, with two successive 3-hourly Minor Geomagnetic Storm (G1) intervals observed at 15-18UTC and 18-21UTC, before eroding to become quieter through the UTC morning of Friday, with the late resurgence falling short of G1.

Energetic Particles / Solar Radiation: No solar radiation storms were observed.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is forecast to remain low through the next four days. Sunspot regions are expected to be in a state of flux in the period, with numerous departures and arrivals on the facing side, and confidence is therefore low. Common class flares are likely at 70%, with a slight chance (20%) of moderate class.

Solar Wind / Geomagnetic Activity: There are unassessed CME candidates on current imagery, with updates to follow in future guidance.

The only CME in the current forecast is therefore the 06 February CME - ongoing since 09/2010UTC. This has undergone a resurgence late in the current reporting period, but ought to ease in earnest later on day one, leaving an ambient solar wind environment at first into day two, Saturday 12 February. The fast wind from a 'coronal hole' is then expected to arrive, perhaps later Saturday and lasting on into Sunday 13 February.

Geomagnetic activity is expected to start just shy of G1 due to residual 06 February CME effects - especially given the slightly elevated fields involved. Mainly quiet conditions should then follow for a time, perhaps increasing again later Saturday and into Sunday 13 February, with isolated G1/Minor Storm intervals possible on onset.

Energetic Particles / Solar Radiation: There is a daily 5% slight chance of S1 given any significant flares from the sunspot regions in the western hemisphere, reducing into the new working week as they disappear.

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Geomagnetic Storms:

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	Yes	20	40	30	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X Ray Flares:

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	20	20	20	20
Very Active	R3 to R5 X	No	2	2	2	2

Solar Radiation Storms - (High Energy Protons):

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	5	5	5	2
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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